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Hospitalizations for Ambulatory Care Sensitive Conditions (ACSC): The factors that matter

by Claudia Sanmartin, Saeeda Khan
and the LHAD research team

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The Longitudinal Health and Administrative Data (LHAD) initiative is a partnership among provincial and territorial ministries of health and Statistics Canada, as well as the Canadian Institute for Health Information, the Canadian Council of Cancer Registries and the Vital Statistics Council for Canada. The objective of the Initiative is to address important information gaps by ensuring that key administrative data, such as those routinely collected through the health system, can be used to undertake pan-Canadian research to improve the understanding of relationships among risk factors, socio-economic characteristics, health status measures and health care utilization. The research involves the linking of provincial and territorial health administrative data within themselves, and with Statistics Canada population health survey data, the births and deaths databases, and the Canadian Cancer Registry. In addition to complementing the important record linkage research already being done within individual provinces, LHAD studies create invaluable opportunities to learn from comparisons among jurisdictions, as well as facilitate larger studies for less common types of events and conditions. In short, the LHAD Initiative is intended to establish the foundation for a Canadian record linkage program to help further the advancement of knowledge about health determinants, outcomes and their relationships.

Statistics Canada is the operational arm of the LHAD partnership. Two divisions within Statistics Canada - the Health Statistics Division (HSD) and the Health Analysis Division (HAD) collaborate in supporting the Initiative.

HSD is responsible for ongoing administrative support including organizing Steering Committee meetings and providing secretariat services to the Initiative. It is also responsible for building and maintaining the LHAD data processing environment, securely storing and processing LHAD datasets, and producing linked analysis files for all approved studies.

HAD provides research support to the LHAD program via the LHAD Research Team. HAD is the primary source of health research within Statistics Canada. Its mandate is to provide high quality, relevant and comprehensive information on the health status of the population and on the health care system. This project represents one of the four research studies undertaken by the LHAD Research team from the research agenda developed by the LHAD Steering Committee in 2008.

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Executive summary

Hospitalizations related to ambulatory care sensitive conditions (ACSC) represent an indirect measure of access to primary care and the capacity of the system to manage chronic conditions such as diabetes, congestive heart failure, chronic obstructive pulmonary disease (COPD) and asthma. ACSC-related hospitalizations are commonly referred to as *avoidable* hospitalizations and thus a measure of the performance of the primary care system. There is limited evidence linking the availability of primary care and ACSC-related hospitalizations. There is, however, growing evidence regarding the role of patient characteristics, such as socioeconomic status, that may place individuals at higher risk for such a hospitalization.

This study represents the first national level assessment of a broad range of factors associated with ACSC-related hospitalizations. The unique feature of this study is the focus on those individuals most at risk – that is, those with at least one ACS condition. The study is based on the linked health survey and hospital data that provide comprehensive information regarding patient characteristics, their access to primary care and whether or not they experienced an ACSC related hospitalization. Understanding the role of these factors may shed light on how primary care services may reduce the risk of these "avoidable" hospital admissions.

Key Findings

- Overall, individuals who experience an ACSC related hospitalization represent only 0.4% of Canadians under the age of 75, but represent 6% of all hospitalized individuals and use nearly 11% of all hospital days.
- Over half of those with an ACSC-related hospitalization were aged 60 or older, compared with less than half among those hospitalized for other reasons, and one in four among those not admitted to hospital.
- Results of age/sex adjusted descriptive statistics indicate that those who had an ACSC-related hospitalization…
  - ➢ reported poorer health across several measures and were more likely to have comorbidities;
  - ➢ were more likely to be in the lowest household income quintile;
  - ➢ were more likely to be daily or former smokers.
- Contrary to expectations, individuals who had an ACSC related hospitalizations were also more likely to be users of primary and specialist care services and more likely to have a regular medical doctor.
- Results of multivariate analyses in which all relevant factors are considered simultaneously indicated that older age (60+years), poor health status, smoking and having an at least one hospitalizations in the previous year increased the odds experiencing an ACSC related admissions for both men and women. Low income and being separated and divorced increased the odds of an ACSC-related admission for men; being underweight significantly increased the odds for women.
- Finally, the report also provides "risk profiles" that highlight the characteristics of individuals at low and high risk of an ACSC-related hospitalization.

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Introduction

Hospital admissions for ambulatory care sensitive conditions (ACSC) such as diabetes, heart disease and respiratory conditions may be indicators of problems with access to primary care. These are conditions for which there is a theoretical relationship between the risk of hospitalization and lack of ambulatory or primary care.[1,2] It is commonly thought that timely and effective primary care can prevent the onset of complications, reduce the risk of acute episodes, and prevent hospitalizations.[3,4] Thus, ACSC- related hospitalizations are commonly referred to as *avoidable* hospitalizations. In Canada, as in other countries, ACSC-related hospitalizations are an indirect measure of access to primary care and the capacity of the system to manage these conditions.[5]

While chronic disease management and ACSC-related hospitalizations are theoretically linked, the evidence for this association is limited. Much of the data are based on ecological studies of the relationship between service availability (for example, number of primary care practitioners) and ACSC-related hospitalizations. Moreover, the results of this research are mixed: some studies show no association,[6,7] and others, the expected negative association, with lower admission rates in areas with more physicians.[8,9]

Evidence about the effect of the type of primary care and patient experiences is also limited. Lower rates of ACSC-related admissions, for example, have been found among Medicare enrolees in managed care programs versus fee-for-service, and in areas with community health centres and rural health clinics.[10,11] A study of patients in an Italian hospital identified a negative relationship between the use of services, satisfaction with primary care, and the likelihood of experiencing an ACSC-related hospitalization.[12]

The role of patient characteristics in ACSC-related admissions has also been examined. Males and older people have been shown to be more likely than females and younger people to experience such admissions.[5,13] Not surprisingly, ACSC-related hospitalizations are more prevalent among people with poorer health and co-morbidities[13,14] and among individuals in low-income areas.[15,16,17] However, much of this information is derived from administrative data, and therefore, limits the patient characteristics that can be assessed. The few studies that have considered a more comprehensive set of patient factors have often been based on surveys of small samples of patients conducted in a single institution or geographic area, thereby compromising the generalizability of the results.

This analysis, by contrast, uses a population-based approach to study a broad set of factors associated with ACSC-related hospitalizations. The unique feature of this study is the nationally representative sample of people most at risk—those with at least one ACSC (asthma, diabetes, emphysema/COPD, epilepsy, heart disease or high blood pressure). The study uses health survey data linked to hospital administrative data. The linked dataset provides a unique opportunity to consider a comprehensive set of characteristics of people who have been admitted to hospital: socio-economic, health status and lifestyle factors, and importantly, their access to primary care. Understanding the role of these factors may shed light on how primary care services may reduce the risk of these "avoidable" hospital admissions.

Data sources

Canadian Community Health Survey

Data from the 2000/2001 Canadian Community Health Survey (CCHS) (cycle 1.1) were linked to the Hospital Morbidity Database (HMDB) (2000/2001 to 2004/2005). The CCHS collects cross-sectional information about the health and health care use of Canadians. The survey covers the non-institutionalized household population aged 12 or older in all provinces and territories, except members of the regular Canadian Forces and residents of Indian reserves, Canadian Forces bases (military and civilian) and some remote areas. A description of the methodology has been previously reported.[18] The overall response rate in 2000/2001 was 85%; the total sample numbered 131,535. Insufficient information was available in the hospital data for Quebec residents' records to be linked (see Hospitalization data); therefore, the 22,667 (17%) CCHS respondents in Quebec were dropped from this analysis. Of the 108,868 respondents who remained, 90,450 had given permission for their survey data to be linked to administrative data. Check-digit algorithms were used to verify the plausibility of the health numbers they provided; 72,363 provided a plausible health number required for data linkage.

Hospitalization Data

Statistics Canada's Hospital Person-Oriented Information Database (HPOI) is a person-level dataset derived from discharge records of inpatients in most of the acute care hospitals and some psychiatric, chronic and rehabilitation hospitals.[19] The discharge records contain demographic (gender, date of birth, postal code), administrative (health number, admission and separation dates) and clinical information derived from the the Hospital Morbidity Database (HMDB) maintained by the Canadian Institute for Health Information.[20] During data processing at Statistics Canada, about 3% of HMDB records for patients aged 12 or older were excluded because of missing or invalid health numbers. The HPOI represents approximately 3.4 million inpatient acute care admissions each year.

Linking health survey and hospital data

The survey and administrative data were linked at the individual level using probabilistic linkage methodology. Unique identifying information including health number, postal code, date of birth and age were used in the linkage. Linkage was conducted only for CCHS respondents living outside Quebec who provided consent to link their survey data to other sources of health information. The linkage was conducted by Statistics Canada. Additional information about the process is provided elsewhere.[21] A recently published evaluation of the linkage between the CCHS and HPOI reported high coverage for the population younger than age 75.[22]

Methodology

Sample

The study sample consists of CCHS respondents aged 12 to 74 (excluding Quebec residents) who gave permission to have their survey data linked to the HMDB and who indicated that they have been diagnosed with at least one of the following ACS conditions: asthma, emphysema/ chronic obstructive pulmonary disorder (COPD), diabetes, epilepsy, heart disease or high blood pressure (n=16,931; N=2.75 million). CCHS interviews were conducted from September 1, 2000 to November 3, 2001. Starting from the date of the CCHS interview, linked hospital records were searched prospectively for four years (1,462 days) for each respondent. Individuals were then "followed" over time in the linked hospital administrative data to determine if they experienced one of the following events: at least one ACSC-related hospitalization admission (n=840); at least one other type of hospitalization (n=4,149); or no hospitalization (n=11,942). Censoring before the end of the four-year period to account for events such as death or moving out of the province was not possible because information about these events was not available or incomplete.

ACSC-related hospitalizations were defined as acute care inpatient hospital admissions for angina, asthma, COPD, diabetes, grand mal status and other epileptic convulsions, heart failure and pulmonary edema and hypertension. ICD9/10 codes listed as the "most responsible" diagnosis were used to identify ACSC-related admissions in accordance with methodology developed by the Canadian Institute for Health Information (see Appendix A).

Analytical techniques

Descriptive analyses were conducted to estimate the prevalence of various demographic, socio-economic, health status and health care use indicators using the SAS software (version 9.1). Prevalence estimates were adjusted to the nationally representative sample of individuals aged 12 to 74 with an ACS condition, as defined in the 2000/2001 CCHS. Bivariate logistic regressions (weighted; adjusted for age and sex) were conducted to identify factors significantly associated with experiencing at least one ACSC-related hospitalization in the four-year period following the survey. Separate analyses were conducted to compare individuals with an ACSC-related hospitalization to: 1) those who experienced at least one other type of hospitalization; and 2) those with no hospitalizations. (Results are provided in the Appendix Tables B and C). Gender-specific multivariate logistic regression analyses were conducted to consider the full range of patient and primary care factors associated with ACSC-related hospitalizations. Only factors that were significant in the bivariate analyses were selected. The stepwise technique was applied to ensure selection of a parsimonious list of factors. The multivariate analyses were conducted using SAS-callable Sudaan (version 9.1.3).

The bootstrap technique was applied to all analyses to account for the complex survey design and to estimate variance and confidence intervals. Survey weights were specifically produced by Statistics Canada for the linked file to adjust for non-response to the CCHS and for the exclusion of records of respondents who did not provide plausible health numbers or give permission for linkage to administrative data. These weights were applied to the analysis file. The weighted data were representative of the Canadian household population residing outside Quebec.

Independent variables

A comprehensive set of patient characteristics was considered to assess the association with ACSC-related hospitalizations. Variables were derived from the CCHS survey data and grouped in the following categories: demographic (age, sex, rural/ urban status, race), socio-economic status (household income, education, family/marital status, immigration status), health status (self-reported health, disability level, presence of co-morbidities, self-reported daily stress, impact of health problems, pain), health behaviours/risk factors (smoking status, body mass index (BMI), physical activity index, fruit and vegetable consumption, community belonging), and access to health care services (access to regular medical doctor, use of family physician and specialist services, hospitalization, unmet healthcare needs) (see Appendix Table A for complete list of variables).

Findings

Rate of ACSC-related hospitalizations among "at risk" individuals

An estimated 4.2 million Canadians aged 12 to 74 have been diagnosed with at least one ACSC. Among this population, 46% reported having been diagnosed with high blood pressure, 43% heart disease, 36% diabetes, 30% asthma, and 16% COPD.

Among this "at risk" group, 161,000 (3.8%) had at least one ACSC-related hospitalization over a four-year period. The most common admissions were for COPD (26%), diabetes (20%), angina (19%), and heart failure and pulmonary edema (16%).

People with an ACSC-related hospitalization constituted just 0.4% of the population aged 12 to 74, but represented about 6% of all hospitalized individuals and used nearly 11% of all hospital days (Figure 1). Consequently, understanding who they are is important.

Characteristics of individuals admitted for an ACSC-related hospitalization

Older and sicker

More than half (52%) of those who experienced an ACSC-related hospitalization were male, compared with about 47% of those who were hospitalized for another reason or not hospitalized at all during the four-year period (Table 1). Over half (53%) of those with an ACSC-related hospitalization were aged 61 or older, compared with 45% of those hospitalized for other reasons, and 23% who were not admitted to hospital. Given these differences in the demographic characteristics of the three groups, the remaining comparative analyses are age/sex adjusted.

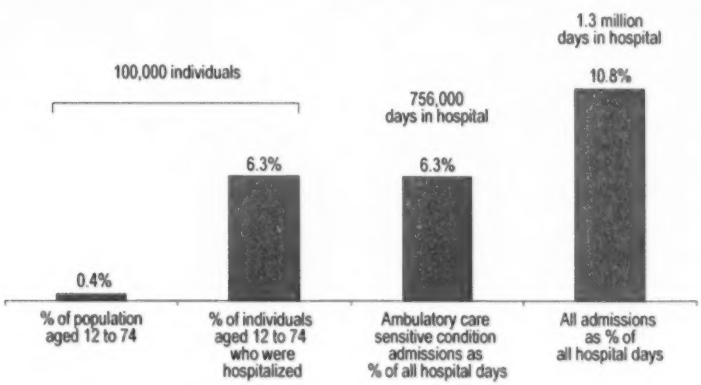
Individuals who had an ACSC-related hospitalization were almost twice as likely to be separated or divorced (14%) than were those hospitalized for other reasons (8%) or not hospitalized at all (7%).

As expected, individuals who experienced an ACSC-related hospitalization reported poorer health across several measures, including fair/poor health (56%) and severe disability (37%). The odds of experiencing an ACSC-related admission were up to 10 times higher for those in fair/poor health, compared with those in excellent health (Appendix Tables B and C).

Individuals who had an ACSC-related hospitalization were more likely to have two or more co-morbid conditions, compared with the other groups: 50% versus 39% and 29%. The odds that people with multiple co-morbid conditions would experience an ACSC-related hospitalization were up to 4.5 times the odds for those with no co-morbidities (Appendix Tables B and C).

Almost one in five individuals who had an ACSC-related hospitalization reported being depressed, compared with one in ten who did not experience a hospital admission (18% versus 10%). They were less likely to report usually being free of pain (54%) than were the comparison groups (64% and 77%).

Figure 1
Population aged 12 to 74 who experienced an avoidable hospitalization, Canada excluding Quebec, 2003/2004


100,000 individuals
1.3 million days in hospital
10.8%
756,000 days in hospital
6.3%
6.3%
0.4%
% of population aged 12 to 74
% of individuals aged 12 to 74 who were hospitalized
Ambulatory care sensitive condition admissions as % of all hospital days
All admissions as % of all hospital days

Source: 2003/2004 Health Person-Oriented Information.

Lower socio-economic status

More than a third of individuals (34%) with an ACSC-related hospitalization were in the lowest household income quintile, compared with 24% of those hospitalized for other reasons and 16% of those not hospitalized (Table 2). Individuals in the lower-middle and lowest income groups had two to four times the odds of experiencing an ACSC-related hospitalization, compared with those in the highest income group (Appendix Tables B and C).

About one person in five (18.2%) who had an ACSC-related hospital admission lived in a household where the highest level of education was less than secondary graduation; the corresponding figures were 16.8% and 12.8% for non-avoidable and no hospitalization,

respectively. The odds that people in lower-education households would experience an ACSC-related hospitalization were two to four times the odds for residents of households in which at least one member was a postsecondary graduate (Appendix Tables B and C).

Lifestyle

One in three individuals who had an ACSC-related hospitalization were daily smokers, compared with 21% and 18% of the comparison groups (Table 3). Regardless of their smoking category (daily, occasional or former), smokers

Table 1
Selected demographic and health status characteristics of individuals by hospital admission status, household population 12 to 74 with an ambulatory care sensitive condition, Canada excluding Quebec, 2000/2001

	At least one avoidable hospitalization (n=840)				At least one non-avoidable hospitalization (n=4,149)				No hospitalization (n=11,942)			
		Age-sex adjusted weighted estimate				Age-sex adjusted weighted estimate				Age-sex adjusted weighted estimate		
			95% confidence interval				95% confidence interval				95% confidence interval	
	Number '000	%	from	to	Number '000	%	from	to	Number '000	%	from	to
Sex												
Male		51.85	46.36	57.29		47.17	44.92	49.43		46.96	45.73	48.19
Female		48.15	42.71	53.64		52.83	50.57	55.08		53.04	51.81	54.27
Age												
20 or younger		4.37[E]	2.75	6.89		4.25	3.27	5.50		11.41	10.65	12.23
21 to 40		9.63[E]	6.83	13.42		15.20	13.41	17.18		25.76	24.50	27.07
41 to 60		32.88	27.89	38.28		35.92	33.56	38.34		40.11	38.79	41.45
61 or older		53.12	47.72	58.44		44.64	42.30	47.00		22.71	21.68	23.77
Self-reported health												
Excellent/Very good	18	14.1	10.3	19.0	251	30.0*	27.5	32.7	1,469	45.3*	44.0	46.7
Good	47	30.3	25.5	35.6	309	34.3	31.7	37.0	1,075	34.3	33.0	35.7
Fair/Poor	96	55.6	50.1	61.0	345	35.7*	33.3	38.1	619	20.4*	19.2	21.6
Health Utilities Index disability category												
No disability	11	9.7[E]	6.9	13.4	98	13.0	11.1	15.2	576	16.9*	16.0	18.0
Mild disability	48	30.3	25.8	35.2	345	36.7*	34.0	39.4	1,456	47.0*	45.5	48.6
Moderate disability	31	20.6	15.8	26.4	159	18.3	16.2	20.6	561	17.7	16.5	18.9
Severe disability	67	37.4	31.9	43.3	289	30.6*	28.3	33.0	543	17.4*	16.3	18.6
Selected comorbidities[†]												
None	16	17.8	13.6	22.9	138	22.8	20.7	25.0	1,011	28.8*	27.8	29.7
One	45	30.8	25.6	36.6	338	37.9*	35.4	40.5	1,311	42.0*	40.6	43.3
Two or more	98	50.2	45.5	54.9	424	38.6*	36.5	40.7	834	29.0*	27.9	30.2
Depressed												
Yes	22	18.4	13.7	24.2	109	13.9	12.1	15.9	327	9.8*	8.9	10.7
No	135	79.1	73.3	83.8	775	83.9	81.8	85.8	2,789	88.7*	87.7	89.6
Self-reported daily stress												
Not at all stressful	23	9.8	7.7	12.5	108	9.6	8.4	11.0	316	11.6	10.7	12.6
Not very stressful	32	17.7	13.4	23.0	199	21.1	18.7	23.7	617	21.7	20.4	23.2
A bit stressful	54	38.3	32.6	44.2	323	39.3	36.3	42.3	1,165	40.2	38.8	41.7
Quite a bit stressful	34	24.5	19.2	30.8	188	22.7	20.2	25.3	648	21.1	19.8	22.5
Extremely stressful	14	9.5[E]	6.1	14.3	60	7.4	5.9	9.0	164	5.3*	4.6	6.0
Impact of health problems												
Sometimes	38	24.4	19.7	29.8	199	21.5	19.5	23.6	637	19.9	18.7	21.1
Often	75	43.4	37.7	49.3	271	28.9*	26.6	31.2	466	15.1*	14.1	16.2
Never	48	32.1	27.2	37.4	435	49.7*	47.0	52.3	2,060	65.0*	63.6	66.4
Usually free of pain												
Yes	83	54.0	48.2	59.7	575	64.4*	61.9	66.9	2,460	77.4*	76.1	78.7
No	77	45.7	40.0	51.5	331	35.6*	33.1	38.1	702	22.5*	21.2	23.8

* significantly different from estimate for those with at least one avoidable hospitalization ($p<0.05$)

† arthritis, chronic obstructive pulmonary disease, heart disease, cancer, high blood pressure, diabetes

E use with caution

Notes: Ambulatory care sensitive conditions (ACSC) are asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure (n=16,931). Age-sex standardized to ACSC population aged 12 to 74, unless otherwise specified.

Source: 2000/2001 Canadian Community Health Survey; 2000/2001 to 2004/2005 Hospital Person-Oriented Information.

were more likely to experience such an admission. The odds of experiencing an ACSC-related hospitalization were two to three times higher among former and daily smokers compared with non-smokers (Appendix Tables B and C).

Weight also appears to matter. Underweight individuals aged 12-74 were up to three times more likely to experience an ACSC-related hospitalization than were normal-weight individuals (5.2% versus 1.5%). Being overweight appears to have a protective effect. Approximately 27% of those who experienced an ACSC-related hospitalization were overweight, compared with more than 30% of the comparison groups. On the other hand, 60% of the people who had ACSC-related hospitalizations reported being physically inactive, compared with about 50% of those who experienced no hospitalization at all (Table 3).

Access to primary and specialist care

If ACSC-related hospitalizations indicate inadequate primary care, it might be expected that people who had such hospitalizations would report less access to primary care services. The results from the linked data, however, suggest otherwise.

Individuals who had an ACSC-related hospitalization were, in fact, more likely than the comparison groups to report that they had access to a regular medical doctor (98% versus 96%

Table 2
Selected socioeconomic and demographic characteristics of individuals by hospital admission status, household population 12 to 74 with an ambulatory care sensitive condition, Canada excluding Quebec, 2000/2001

	At least one avoidable hospitalization (n=840)				At least one non-avoidable hospitalization (n=4,149)				No hospitalization (n=11,942)			
		Age-sex adjusted weighted estimate				Age-sex adjusted weighted estimate				Age-sex adjusted weighted estimate		
			95% confidence interval				95% confidence interval				95% confidence interval	
	Number '000	%	from	to	Number '000	%	from	to	Number '000	%	from	to
Household income quintile												
Lowest	52	34.3	28.8	40.3	208	23.9*	21.6	26.3	513	16.2*	15.2	17.3
Lower middle	34	19.4	14.9	24.8	167	16.8	15.1	18.7	562	18.1	17.0	19.2
Middle	21	11.5	8.4	15.7	143	16.2*	14.1	18.4	583	18.6*	17.5	19.8
Upper middle	18	12.2	8.8	16.6	141	15.5	13.8	17.4	538	16.6*	15.6	17.7
Highest	15	11.6[E]	8.2	16.0	124	15.1	13.2	17.1	605	18.8*	17.7	19.9
Education												
Less than secondary graduation	70	41.6	36.4	46.9	320	35.9	33.6	38.3	952	30.4*	29.1	31.7
Secondary graduation	22	14.8	10.9	19.7	167	18.1	16.3	20.1	612	19.3	18.2	20.5
Some postsecondary	13	8.9[E]	5.9	13.2	66	7.4	6.3	8.7	249	7.7	6.9	8.4
Postsecondary graduation	52	32.8	28.0	38.0	346	37.8	35.5	40.2	1,327	41.9*	40.5	43.3
Highest level of household education												
Less than secondary graduation	38	18.2	15.4	21.4	177	16.8	15.2	18.5	373	12.8*	11.9	13.7
Secondary graduation	22	13.9	10.1	18.8	133	15.1	13.4	17.0	475	15.0	14.0	16.2
Some postsecondary	17	13.4[E]	9.5	18.7	72	8.5*	7.1	10.1	242	7.5*	6.8	8.3
Postsecondary graduation	77	49.5	43.5	55.5	505	57.6*	54.8	60.3	2,005	62.5*	61.0	64.0
Family/Marital status												
Child, with parent(s)	8	9.7[E]	6.9	13.6	48	10.3	8.9	11.9	406	11.0	10.4	11.7
Married/Common-law	99	55.6	49.8	61.2	611	63.4*	61.1	65.6	1,992	64.8*	63.5	66.0
Widowed	19	7.6	5.9	9.7	87	6.9	6.1	7.7	141	5.2*	4.6	5.8
Separated/Divorced	23	14.0	10.6	18.4	81	8.6*	7.5	9.9	233	7.5*	6.8	8.2
Single, never married	13	13.1[E]	9.2	18.3	78	10.8	9.1	12.8	392	11.6	10.7	12.6
Immigrant status												
Non-immigrant	128	83.9	79.0	87.8	721	81.8	79.3	84.1	2,489	77.8*	76.2	79.3
Immigrant (10 years or more in Canada)	30	15.0	11.2	19.7	166	16.1	13.9	18.5	551	18.4	17.0	19.9
Immigrant (less than 10 years in Canada)	F	F	F	F	18	2.1[E]	1.3	3.5	124	3.8*	3.1	4.5

* significantly different from estimate for those with at least one avoidable hospitalization ($p<0.05$)
[E] use with caution
F too unreliable to be published
Notes: Ambulatory care sensitive conditions (ACSC) are asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure (n=16,931). Age-sex standardized to ACSC population aged 12 to 74, unless otherwise specified.
Source: 2000/2001 Canadian Community Health Survey; 2000/2001 to 2004/2005 Hospital Person-Oriented Information.

Table 3
Selected health behaviours and risk factors by hospital admission status, household population 12 to 74 with ambulatory care sensitive conditions, Canada excluding Quebec, 2000/2001

	At least one avoidable hospitalization (n=840)				At least one non-avoidable hospitalization (n=4,149)				No hospitalization (n=11,942)			
		Age-sex adjusted weighted estimate				Age-sex adjusted weighted estimate				Age-sex adjusted weighted estimate		
			95% confidence interval				95% confidence interval				95% confidence interval	
	Number '000	%	from	to	Number '000	%	from	to	Number '000	%	from	to
Smoking												
Never	28	21.6	17.3	26.6	244	27.9*	25.6	30.4	1,099	33.9*	32.6	35.3
Former	83	44.8	39.4	50.3	425	42.3	39.8	44.8	1,336	43.8	42.4	45.2
Occasional	5	3.7[E]	2.2	6.2	36	5.4	3.9	7.5	116	3.4	3.0	4.0
Daily	45	29.9	25.0	35.3	199	24.2*	22.0	26.5	607	18.6*	17.6	19.7
Body mass index, ages 12 to 74												
Underweight	7	5.2[E]	2.8	9.4	14	1.5[E]*	1.1	2.2	49	1.5*	1.2	1.9
Normal	58	37.8	32.4	43.6	297	35.0	32.3	37.8	1,212	37.5	36.1	38.8
Overweight	46	27.3	22.3	32.9	321	33.2*	30.9	35.7	1,069	34.6*	33.4	36.0
Obese	49	29.5	24.9	34.6	271	29.9	27.8	32.2	826	26.1	24.9	27.4
Body mass index, ages 20 to 64												
Underweight	F	F	F	F	F	F	F	F	36	1.5	1.1	2.0
Normal	32	33.5	27.6	40.1	166	30.5	26.7	34.6	810	36.2	34.0	38.4
Overweight	24	24.0	18.5	30.4	193	34.8	31.0	38.8	805	35.0	32.9	37.2
Obese	34	38.0	32.1	44.4	191	31.5	28.4	34.9	691	27.2*	25.5	28.9
Physical activity												
Active	26	21.4	16.8	26.8	152	18.2	16.1	20.5	703	21.8	20.7	23.0
Moderately active	21	12.2	9.1	16.0	186	21.1*	18.8	23.6	746	23.8*	22.5	25.1
Inactive	101	59.9	54.5	65.1	517	55.1	52.4	57.8	1,558	49.5*	47.9	51.1
Vegetable and fruit consumption												
Five or more servings per day	54	35.8	30.3	41.6	328	34.6	32.1	37.1	1,165	37.3	36.0	38.7
Fewer than five servings per day	105	62.9	57.0	68.4	566	64.1	61.5	66.5	1,966	61.6	60.2	63.0
Sense of community belonging												
Very strong	32	18.1	14.4	22.5	182	18.7	17.0	20.5	548	17.9	16.8	19.0
Somewhat strong	58	37.7	31.8	43.9	349	38.6	35.9	41.4	1,276	40.3	38.8	41.9
Somewhat weak	30	19.8	15.8	24.5	200	23.0	20.8	25.4	794	24.8*	23.4	26.1
Very weak	28	17.5	13.6	22.1	120	13.6	11.6	15.9	377	11.8*	10.9	12.7

* significantly different from estimate for those with at least one avoidable hospitalization ($p<0.05$)
[E] use with caution
F too unreliable to be published
Notes: Ambulatory care sensitive conditions (ACSC) are asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure (n=16,931). Age-sex standardized to ACSC population aged 12 to 74, unless otherwise specified.
Source: 2000/2001 Canadian Community Health Survey; 2000/2001 to 2004/2005 Hospital Person-Oriented Information.

and 94%) (Table 4). They were also more likely to be frequent users of care, with almost 70% reporting four or more occasions when they accessed their primary care physician; this compares with 50% of those who had no hospitalization. Similarly, they were more likely to have reported four or more specialist consultations (24% versus 17% and 9%). As well, they were more likely to have been hospitalized at least once in the past year (41% versus 19% and 9%) (Table 4).

Despite greater access to and use of services, individuals who had an ACSC-related hospitalization were also more likely to report an unmet health care need (20%) than were those who experienced no hospitalization at all (15%). (Table 4)

Which factors matter more? Results of multivariate analysis

The descriptive results of the analysis of the linked data confirm that patient characteristics such as health status, socio-economic status and risk factors, as well as access to health care, are associated with ACSC-related hospitalizations. But which factors matter more? And do the results differ for men and women? To answer these questions, we looked at a range of factors simultaneously in gender specific multivariate regression models to identify which factors were most associated with an ACSC-related hospitalization relative to those who were not admitted to hospital over the four year follow-up period. We began with those factors found to be

Table 4
Health care use by hospital admission status, household population 12 to 74 with ambulatory care sensitive conditions, Canada excluding Quebec, 2000/2001

	At least one avoidable hospitalization (n=840)				At least one non-avoidable hospitalization (n=4,149)				No hospitalization (n=11,942)			
		Age-sex adjusted weighted estimate				Age-sex adjusted weighted estimate				Age-sex adjusted weighted estimate		
			95% confidence interval				95% confidence interval				95% confidence interval	
	Number '000	%	from	to	Number '000	%	from	to	Number '000	%	from	to
Have regular medical doctor												
Yes	157	98.3	97.0	99.0	873	95.6*	94.4	96.5	2,957	93.9*	93.3	94.5
No	4	1.7[E]	1.0	3.0	32	4.4*	3.5	5.6	207	6.1*	5.5	6.7
Contacts with family doctor in past 12 months												
None	7	4.3[E]	2.5	7.4	54	6.5	5.4	7.8	286	8.7*	7.9	9.6
One to three	39	26.0	20.7	32.0	266	30.5	27.9	33.2	1,332	41.3*	40.0	42.7
Four or more	115	69.6	63.4	75.1	583	62.8	59.9	65.5	1,544	49.9*	48.5	51.2
Contacts with specialists in past 12 months												
None	64	39.8	34.4	45.5	463	52.3*	49.8	54.7	2,059	64.7*	63.3	66.0
One to three	60	35.7	30.0	41.9	287	30.8	28.5	33.1	836	26.8*	25.6	28.1
Four or more	37	24.4	19.3	30.4	154	16.9*	15.1	18.8	267	8.5*	7.7	9.3
Overnight hospital stay in past 12 months												
Yes	62	40.9	35.0	47.0	174	19.0*	17.1	21.0	276	8.9*	8.2	9.7
No	99	58.8	52.7	64.7	730	80.8*	78.8	82.7	2,888	91.1*	90.3	91.8
At least one unmet health care need in past 12 months												
Yes	29	20.1	15.9	25.1	152	17.9	16.1	19.8	479	14.6*	13.7	15.6
No	132	79.9	74.9	84.1	753	82.1	80.1	83.8	2,686	85.4*	84.4	86.3

* significantly different from estimate for those with at least one avoidable hospitalization ($p<0.05$)
[E] use with caution
Notes: Ambulatory care sensitive conditions (ACSC) are asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure (n=16,931). Age-sex standardized to ACSC population aged 12 to 74, unless otherwise specified.
Source: 2000/2001 Canadian Community Health Survey; 2000/2001 to 2004/2005 Hospital Person-Oriented Information.

significantly associated with an ACSC-related hospitalization in the previous analysis and applied a stepwise regression approach allowing the selection a parsimonious sets of factors. The results are presented in Table 5.

Age, disability and comorbid conditions matter

Older age remained significantly associated with ACSC-related hospitalizations. Men aged 60 or older experienced a 3.5-fold increase in the odds of experiencing such an admission, compared with those aged 21 to 40. The results for women were similar, with an odds ratio of 2.4 (Table 5).

Disability and co-morbid conditions also remained important, but the results varied by gender. Men with severe disability were at higher risk of an ACSC-related admission (OR=2.96). For women, multiple co-morbidities matter: women with two or more chronic conditions had more than four times the odds of an ACSC-related hospitalization (OR=4.41) (Table 5).

Low income matters

The association between low income and ACSC-related hospitalizations persisted for only men when adjusting for other factors. The odds of experiencing an ACSC-related hospitalization were three times as high for men in the lowest income quintiles, compared with those in the highest quintile (OR=3.25). Men in the lower-middle income also had significantly high odds of such a hospitalization (Table 5).

The odds that separated/divorced men would experience an ACSC-related hospitalization were twice those of married men (OR=2.05).

Association with smoking and weight varies by gender

Smoking continued to be significant, even when other factors were taken into account. Among men, all categories of smokers, former, daily and occasional experienced a higher odds of an ACSC-related hospitalization however, only the results for former smoker were statistically significant (OR=2.2). Among women, the odds were significantly high for daily smokers (OR=1.8) (Table 5).

Table 5
Adjusted odds ratios relating patient characteristics to ACSC-related hosptializations versus no hospitalizations, household population 12 to 74 with ambulatory care sensitive chronic conditions, Canada (excluding Quebec), 2000/2001

	Men with ACSC			Women with ACSC		
	Adjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval	
Characteristics		from	to		from	to
Demographic						
Age						
20 or younger[1]	1.63	0.33	8.00	1.47	0.50	4.35
21 to 40	1.00	...	...	1.00	...	...
41 to 60	1.36	0.60	3.04	1.22	0.69	2.17
61 or older	3.49*	1.50	8.12	2.43*	1.30	4.55
Socio-economic						
Income quintile						
Lowest	3.25*	1.67	6.35	1.29	0.68	2.46
Lower-middle	2.9*	1.47	5.72	0.68	0.33	1.40
Middle	2.03*	1.03	4.02	0.45*	0.21	0.93
Upper-middle	2.15*	1.01	4.56	0.61	0.27	1.41
Highest[1]	1.00	...	...	1.00	...	...
Family/Marital Status						
Child with parent(s)	0.64	0.20	2.07	...	...	...
Married/Common-law[1]	1.00	...	...	...	...	...
Widowed	0.79	0.34	1.80	...	...	...
Separated/Divorced	2.05*	1.09	3.88	...	...	...
Single, never married	1.10	0.57	2.12	...	...	...
Health status						
Health Utilities Index (HUI) disability categories						
No disability[1]	1.00	...	...	...	...	...
Mild disability	1.57	0.73	3.41	...	...	...
Moderate disability	1.84	0.80	4.21	...	...	...
Severe disability	2.96*	1.30	6.76	...	...	...
Select comorbidities[2]						
None[1]	...	...	...	1.00	...	...
One	...	...	...	1.72	0.91	3.23
Two or more	...	...	...	4.41*	2.26	8.62
Health beahviours / Risk factors						
Smoking						
Never[1]	1.00	...	...	1.00	...	...
Former	2.22*	1.21	4.08	1.10	0.73	1.66
Occasional	1.47	0.40	5.36	1.14	0.48	2.73
Daily	1.91	0.93	3.93	1.80*	1.18	2.74
Body Mass Index (BMI)						
Underweight	1.36	0.22	8.35	5.87*	2.58	13.34
Normal[1]	1.00	...	...	1.00	...	...
Overweight	0.59*	0.37	0.93	1.15	0.76	1.74
Obese	0.72	0.45	1.14	1.18	0.76	1.85
Physical activity index						
Active[1]	...	...	...	1.00	...	...
Moderate	...	...	...	0.84	0.46	1.54
Inactive	...	...	...	1.64*	1.02	2.64
Experience with health care						
Contacts with other doctors (specialists) in past 12 months						
None[1]	1.00	...	...	...	...	...
One to three	1.83*	1.24	2.70	...	...	...
Four or more	2.75*	1.55	4.88	...	...	...
Stayed overnight in the hospital at least once in past 12 months						
No[1]	1.00	...	...	1.00	...	...
Yes	3.13*	1.99	4.94	4.30*	2.93	6.32

[1] reference category
[2] Arthritis, chronic obstructive pulmonary disease, heart disease, cancer, high blood pressure and diabetes
Note: Individuals aged 12 to 74 years in the CCHS who had at least one Ambulator Care Sensitive Condition (ACSC) (asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure).
Source: Linked 2000/01 Canadian Community Health Survey (CCHS) and 2004/05-2005/06 Health Person Oriented Information (HPOI) (excludes Québec).

Associations with BMI also differed by gender. Among men, being overweight had a protective effect (OR=0.59) against ACSC-related hospitalizations. Among women, the odds of an ACSC-related hospitalization were significantly high (OR=5.87) for those who were underweight, compared with normal-weight women. Being overweight and obese were also associated with an elevated risk of experiencing such an admission but the results were not statistically significant. (Table 5).

Among women, lack of physical activity was associated with higher odds of an ACSC-related hospitalization (OR=1.6), but the level of physical activity did not appear to matter for men.

Access to primary care not significant

Men who used more specialist and hospital services had significantly high odds of an ACS-related hospitalization. Men and women who were hospitalized at least once in the previous year were at higher odds (OR=3.13; OR=4.3 respectively) of experiencing such an event.

Access to primary care services (regular medical doctor and visits with family doctors) was not significantly associated with ACSC-related hospitalizations after adjusting for other factors.

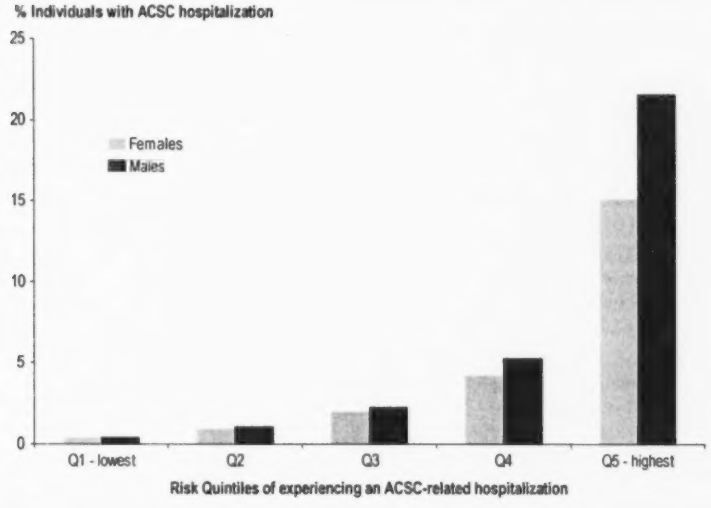
"Risk" profiles: Who is at greatest risk of an ACSC-related hospitalization

With the results of the multivariate regression analyses, profiles of individuals at varying risk of experiencing an ACSC-related hospitalization can be constructed. Using the gender-specific regression models, the predicted probability of experiencing an ACSC-related hospitalization was calculated for all individuals in the study sample. Based on these probabilities, individuals were grouped into risk quintiles, ranging from "low" risk (Quintile 1) to "high" risk (Quintile 5). The members of each group are described in terms of the most prevalent characteristics determined to be significantly associated with ACSC-related hospitalizations in the previous regression analysis (Tables 6 and 7; Appendix Tables D to G).

The average predicted probability of experiencing an ACSC-related hospitalization ranged from 0.4% (Quintile 1) to 15.1% (Quintile 5) among women and between 0.4% (Quintile 1) and 21.6% (Quintile 5) among men.

As expected, the predicted probabilities are linearly related to the proportion of individuals who actually experienced an ACSC-related hospitalization in each risk quintile, providing evidence of the robustness of the models. The majority of ACSC-related hospitalizations were among people in the highest risk group – estimated to be 39,000 hospitalizations among women and 46,000 among men (Figure 2).

Figure 2
Predicted probability of experiencing an ACSC-related hospitalization (quintiles) by gender among those aged 12 to 74 among those with an ambulatory care sensitive chronic condition, Canada, excluding Quebec



Source: 2003/2004 Health Person-Oriented Information.

Results for women

For women in the highest risk group (Quintile 5), the probability of experiencing an ACSC-related hospitalization ranged from 6% to 50% (Table 6). This group was further subdivided into three groups as they have different risk profiles. Women with a 6% to 9% probability of an ACSC-related hospitalization were, on average 55 years of age and in the lowest to lower-middle income groups. They had 2 or more co-morbid chronic conditions and were generally inactive.

Women at the highest risk of experiencing an ACSC-related hospitalization (i.e. >50%) were on average 64 years of age and primarily from the lowest income quintile. Most had two or more co-morbidities, and most were either former or daily smokers. These women also tended to be underweight and generally reported being inactive. They were higher users of specialist services, and most experienced at least one hospitalization in the previous 12 months.

Results for men

Among men in the highest risk group (Quintile 5), the probability of an ACSC-related hospitalization varied from less than 10% to 75%. This high-risk group was divided into three subgroups (Table 7). Those with a probability of between 9% to 25% were on average 60 years of age, in the lowest to lower middle income groups, and were more likely to be married or formerly married. Men in this group reported a range of disability levels from mild to severe. They were generally former or daily smokers.

Men at the greatest risk of experiencing an ACSC-related hospitalization (50+%) were on average 67 years of age and primarily from the lowest income quintile and were married or formerly married (i.e. widowed or divorced). Most reported severe disabilities, and identified themselves as former smokers. Unlike men in other risk groups, high-risk men were tended to have used specialists services four or more times in the previous year, and in most cases, had experienced at least one hospitalization.

Table 6
Patient profiles for ACSC-related hospitalizations by risk quintile, women, aged 12 to 74, Canada, excluding Quebec

	Q1	Q2	Q3	Q4	Q5		
Probability (mean)	**0.04%**	**1.00%**	**2.00%**	**4.00%**	**6% to 9%**	**10% to 49%**	**50%+**
Mean age (years)	35	43	49	54	55	59	64
Income quintile	Lower middle to Upper middle	Lower middle to Highest	All income levels	All income levels	Lowest to Lower middle	Lowest to Lower middle	Lowest
Comorbidities	None	None or 1	1 or 2+	1 or 2+	2+	2+	2+
Smoking status	Never or Former	Never, Former or Daily	Never, Former or Daily	Never, Former or Daily	Never, Former or Daily	Former and Daily smokers	Former and Daily smokers
Body Mass Index	Normal or Overweight	Normal to Overweight	Normal to Obese	Normal to Obese	Normal to Obese	Underweight to Obese	Underweight
Physical activity	All levels	Moderate or inactive	Inactive	Inactive	Inactive	Inactive	Inactive
Contacts with specialists	None	None or 1-3	None or 1-3	None or 1-3	None to 4+	None to 4+	None to 4+
Hospitalization in previous year	No	No	No	No	No	Mixed	Yes

Table 7
Patient profiles for ACSC-related hospitalizations by risk quintile, men, aged 12 to 74, Canada, excluding Quebec

	Q1	Q2	Q3	Q4	Q5		
Probability (mean)	**0.42%**	**1.08%**	**2.28%**	**5.27%**	**9% to 25%**	**26% to 50%**	**50%+**
Mean age (years)	36	40	46	53	60	63	67
Income quintile	Upper middle to Highest	Middle to Highest	Lower middle to Highest	Lowest to Uppder middle	Lowest to lower middle	Lowest to lower middle	Lowest to lower middle
Family status	Married[1] or Child with parents	Married[1] or Child with parents	Married[1] or Single	Married[1] or Single	Married[1] or formerly married[2]	Married[1] or formerly married[2]	Married[1] or formerly married[2]
Disability Level	None to mild disability	None to mild disability	Mild to moderate disability	Mild to severe diability	Mild to severe diability	Moderate to severe disability	Severe disability
Smoking status	Never or former smoker	Never or former smoker	Former or Daily smoker	Former or Daily smoker	Former or Daily smoker	Former or Daily smoker	Former smoker
Contacts with specialists	None	None	None	None or 1-3	None, 1-3 or 4+	1-3 or 4+	4+
Hospitalization in previous year	No	No	No	No	No	Mixed	Yes

[1] includes common-law
[2] includes widowed, divorced or separated

Discussion

This study is the first national-level population-based analysis of patient and primary care factors associated with ACSC-related or "avoidable" hospitalizations in Canada. A unique feature of the study is the focus on individuals most at risk—those with at least one ACS chronic condition. The linked health survey and hospital data provide an opportunity to better understand the extent to which patients' characteristics and measures of access to primary care play a role in why some individuals with chronic conditions experience ACSC-related hospital admissions, while others do not. The risk profiles help to focus on individuals at highest risk.

Overall, patient factors played a key role in ACSC-related hospitalizations, while access to a primary care appeared to matter less, at least in terms of service volume. Findings in the literature about the relationship between primary care services and ACSC-related admissions are mixed. The results of this study provide some evidence that greater access to primary care services does not necessarily reduce the risk of experiencing an ACSC-related hospitalization. In fact, people who experienced an ACSC-related hospitalization were more likely to have a regular medical doctor and to be high users of primary care services. However, when other factors were taken into account, access to primary care did not appear to matter.

While the study results do not appear to support increasing the volume of primary care services to reduce the risk of ACSC-related hospitalizations, the results cannot address the issue of appropriate use of services nor the potential role of quality of care. Given the lack of information about disease severity, the study results cannot speak to whether patients are actually receiving an appropriate level of service to meet their needs. Furthermore, data limitations also restricted the possibility of examining whether the type and quality of primary care services accessed by individuals with chronic conditions matter for ACSC-related admissions. It may be that while more services do not appear to reduce the risk of ACSC-related admissions, the type of services (access to multi-disease care, prevention programs) may matter.

The results about patient characteristics may offer some insight about where and how primary care can play a role in reducing what maybe be truly avoidable hospitalizations. The risk profiles provide clear evidence that a range of patient factors matter for ASC-related hospitalizations, and that those at highest risk have multiple issues related to that risk. There are three potential ways this information can be used to avoid these hospitalizations: 1) to identify individuals at high risk; 2) to identify the type of primary care services that may be required to meet the needs of this patient population; and 3) to identify situations/solutions that may be beyond the scope of primary care.

Limitations

- While the use of population-based health surveys provides the opportunity to assess ACSC-related hospitalizations among those "at risk" (with an ACS condition), the generalizability of the results is restricted to the household population aged 12 or older. Consequently, the results do not necessarily represent the experiences of the very young or the institutionalized population.
- Selection of the sample was based on self-reported information provided in the CCHS about an ACS condition that had been diagnosed by a health care provider, and that had lasted or was expected to last more than six months. This information has not been clinically validated.
- Information about disease severity was not available. General health status measures, such as self-reported health, disability level and co-morbidities, were used as proxy indicators.
- The CCHS information about the primary care experiences of respondents is limited. Thus, access to primary care was based on information about access to a regular medical doctor and volume of family physician visits. The study cannot address the role of the type or quality of primary care in ACSC-related hospitalizations nor assess the appropriateness of service use.

Identifying "high-risk" patients

The risk profiles suggest that individuals at highest risk often share key characteristics, including poor health, and as a result, higher use of specialists and hospital services. For both men and women, experiencing a hospital admission in the previous year was associated with significantly higher odds of an ACSC-related hospitalization, even when other potentially confounding factors were taken into account.

Patterns of service use can provide valuable information to identify those who may be at greater risk of ACSC-related hospitalizations. Currently, health care use information is utilized by health care providers in the UK and the US to identify patients at high risk of short-term hospitalization. These individuals are provided with intense ambulatory/primary care to address critical needs and avoid adverse events.. Recently in Canada, use of emergency room services was identified as a key predictor of early death and unplanned readmissions among hospitalized individuals.[23] Information on service use, in conjunction with other known risk factors (co-morbidities, smoking) may help primary care providers identify those most at risk of an ACSC-related admission, and who may benefit from more intense ambulatory care to avoid future hospitalizations related to their chronic conditions.

The role of primary care

Findings about the individual characteristics associated with increased odds of ACSC-related hospitalizations can be used by providers to better understand how primary care services may meet the needs of these people. The results clearly point to the role of disability (men) and co-morbid conditions (women) in increasing the odds of an ACSC-related hospitalization. The results also provide new evidence about the role of lifestyle indicators, such as smoking and physical activity (women). The risk profiles suggest that those at highest risk tend to have more than one of these factors.

More and more people have multiple chronic conditions. In Canada, approximately 30% of individuals with chronic conditions have at least two co-morbid conditions (the percentage rises above 50% among those with diabetes). Many of these chronic conditions have been linked to a handful of risk factors such as smoking.[24] Considerable efforts have been made to improve the delivery of primary care to Canadians with chronic conditions. Collaboratives such as those established in British Columbia and Newfoundland are designed to provide a range of services, including both disease management and preventive services, to improve the health of patients with chronic conditions such as diabetes.[25] The results of this study provide further evidence of the value of these efforts in addressing the needs of people with multiple chronic conditions and risk factors that place them at greater risk of complications and hospitalization.[26]

Beyond primary care...

While some risk factors identified in this study are amenable to primary care intervention, others, for example low income, may not be. This analysis adds evidence derived at the individual level regarding the association between socio-economic status and ACSC-related hospitalization, which to date had largely been derived from ecological studies.[15,27] Much more information is needed about the specific role income plays in increasing individuals risk of an ACSC-related hospitalization to determine whether the response lies within the primary care system. In a publicly funded health care system that provides services based on need, not ability to pay, it is not clear why lower-income individuals are more likely to experience ACSC-related hospitalizations.

A possible explanation is that income is actually a marker for other important factors such as disease severity. Considerable evidence links low income and poor health status: individuals in lower-income households are more likely than people in more affluent households to have multiple chronic conditions, poorer health and an increased need for healthcare services. With the data available for this study, it was not possible to explicitly adjust for disease severity. Nonetheless, the association with household income persisted when proxy measures such as disability status and use of health care services were taken into account.

Alternatively, the association with household income may represent a more systematic disadvantage that compromises individuals' access to needed services, thereby potentially placing them at higher risk of adverse events. Growing evidence points to differential access to and use of health care by income including among those with ACS chronic conditions.[28-30] The health care needed by people with ACS chronic conditions often extends beyond publicly provided services. These individuals often require pharmaceuticals and monitoring devices (for example, glucose monitoring) that may entail out-of-pocket expenditures. Public insurance is available for lower-income groups to alleviate this economic burden, but some people may be "slipping through the cracks." In fact, even when insurance status is taken into account, lower-income groups are generally less likely to use services that require out–of-pocket expenditures.[31] It may be that low- income individuals with ACS chronic conditions have limited access to the full range of health care services required to monitor and manage their conditions, thus placing them at higher risk of adverse events such hospitalizations.

Similarly, meeting the needs of underweight women, who are at a significantly higher risk of an ACSC-related hospitalization than normal-weight women, may extend beyond the primary care system. A number of reasons could account for their high odds of ACSC-related hospitalizations. Being underweight is often associated with poor health and may be a marker for disease severity. The results of the risk profile indicate that underweight women most at risk for an ACSC-related hospitalization were also more likely to have multiple co-morbidities, and thus, likely poorer overall health.

Being underweight is also a result of nutritional risk, particularly among community dwelling elderly women in lower-income groups. Good nutrition and maintenance of healthy weight are generally associated with better health and prolonged life among the elderly.[32,33] Poor nutrition is common among community-dwelling seniors, particularly those in lower income groups with rates estimated to be as high as 40% to 50%.[34,35] Factors such as poor health due to chronic conditions, restricted budget and living or eating alone have all been found to contribute to nutritional risk among community dwelling elders[36,37] and the consequences can be serious, including decreased quality of life and premature mortality.[38,39]

It is possible that the links between underweight and low income and ACSC-related admissions among women in this study may, in part, be related to poor nutrition. Although causality cannot be determined based on the available data, poor nutrition may be related to overall declines in health among an already vulnerable population. The combination of poor health and poor nutrition may place women with chronic conditions at higher risk of complications, and therefore, at higher risk of hospitalization. If this is, indeed, the case, the question is whether primary health care has a

role in improving the nutrition of these women to avoid these hospitalizations. In one Canadian study, encouragement from health professionals was identified as an important facilitator in improving the dietary habits of women at nutritional risk.[40] Health care providers may also play a part in screening elderly patients to identify those who may be in the early stages of nutritional risk. Primary care models may also provide some of the secondary prevention programs, such as nutritional counselling.[41]

In Canada, community-based services have traditionally been key in supporting the nutritional needs of community-dwelling elders at risk of poor nutrition. Programs such as meals-based delivery services, nutrition education, and cooking classes are provided by various groups including municipal governments and charitable organizations. Healthy eating was recently identified as one of five focus areas in the *Healthy Aging in Canada* brief prepared for federal, provincial and territorial departments[42] Yet despite this attention, policies at the community level to meet the nutritional needs of the elderly are lacking. While some policies identify the needs of this population, few plans are in place to promote this agenda at the national level. The authors call on dieticians at the public health, community and government levels to advocate on behalf of this patient population to publicize the need for community-based nutritional services.[43]

Conclusions

ACSC-related hospitalizations indicate potential problems in the delivery of primary care, and are, therefore, of interest to policy- and decision-makers. It is presumed that timely and effective primary care can prevent the onset of complications, control acute episodes, and thereby, avoid hospitalizations. While most of the research has focussed on the role of primary care service, emerging evidence suggests that patient factors, such as socio-economic status, are also important. The results of this study provide new data about the role of factors, such as co-morbidities, low income and lifestyle, in placing individuals at risk of an ACSC-related hospitalization. While some of these factors may be addressed by the primary care system, other solutions may lie beyond its scope.

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Appendix A - Technical notes for defining Ambulatory care sensitive related hospitalizations *(Source: Canadian Institute for Health Information, January 2008)*

Numerator:

Inclusion criteria:

Any most responsible diagnosis code of:

- Grand mal status and other epileptic convulsions
  ICD-9/9CM: 345
  ICD-10-CA: G40, G41
- Chronic obstructive pulmonary diseases (COPD)
  Any most responsible diagnosis (MRDx) code of:
  ICD-9/9CM: 491, 492, 494, 496
  ICD-10-CA: J41, J42, J43, J44, J47
  MRDx of Acute lower respiratory infection, only when a secondary diagnosis of J44 *("Secondary diagnosis" refers to a diagnosis other than most responsible)* in ICD-10-CA or 496 in ICD-9/9CM is also present:
  ICD-9/9CM: 480 – 486, 466, 487.0
  ICD-10-CA: J10.0, J11.0, J12-J16, J18, J20, J21, J22
- Asthma
  ICD-9/9CM: 493
  ICD-10-CA: J45
- Diabetes
  ICD-9: 250.0, 250.1, 250.2, 250.7
  ICD-9-CM: 250.0, 250.1, 250.2, 250.8
  ICD-10-CA: E10.0^^, E10.1^^, E10.63, E10.9^^
  E11.0^^, E11.1^^, E11.63, E11.9^^
  E13.0^^, E13.1^^, E13.63, E13.9^^
  E14.0^^, E14.1^^, E14.63, E14.9^^
- Heart failure and pulmonary edema (Excluding cases with cardiac procedures)
  ICD-9/9CM: 428, 518.4
  ICD-10-CA: I50, J81
- Hypertension (Excluding cases with cardiac procedures)
  ICD-9/9CM: 401.0, 401.9, 402.0, 402.1, 402.9
  ICD-10-CA: I10.0, I10.1, I11
- Angina (Excluding cases with cardiac procedures)
  ICD-9: 411, 413
  ICD-9-CM: 411.1, 411.8, 413
  ICD-10-CA: I20, I23.82, I24.0, I24.8, I24.9
- List of cardiac procedure codes for exclusion *(code may be recorded in any position. Procedures coded as cancelled, previous and "abandoned after onset" are excluded)*:
  CCI: 47^^, 480^-483^, 4891, 4899, 492^-495^, 497^, 498^
  ICD-9-CM: 336, 35^^, 36^^, 373^, 375^, 377^, 378^, 3794-3798
  CCI: 1HA58, 1HA80, 1HA87, 1HB53, 1HB54, 1HB55, 1HB87, 1HD53, 1HD54, 1HD55, 1HH59, 1HH71, 1HJ76, 1HJ82, 1HM57, 1HM78, 1HM80, 1HN71, 1HN80, 1HN87, 1HP76, 1HP78, 1HP80, 1HP82, 1HP83, 1HP87, 1HR71, 1HR80, 1HR84, 1HR87, 1HS80, 1HS90, 1HT80, 1HT89, 1HT90, 1HU80, 1HU90, 1HV80, 1HV90, 1HW78, 1HW79, 1HX71, 1HX78, 1HX79, 1HX80, 1HX83, 1HX86, 1HX87, 1HY85, 1HZ53 rubric (except 1HZ53LAKP), 1HZ54, 1HZ55 rubric (except 1HZ55LAKP), 1.HZ.56, 1.HZ.57, 1HZ59, 1HZ80, 1HZ85, 1HZ87, 1IF83, 1IJ50, 1IJ54GQAZ, 1IJ55, 1IJ57, 1IJ76, 1IJ80, 1IK57, 1IK80, 1IK87, 1IN84, 1LA84, 1LC84, 1LD84, 1YY54LANJ

Exclusion criteria:

1. Death before discharge
2. Individuals 75 years of age and older

Comments:

A new "combination" code for acute lower respiratory infections in patients with Chronic Obstructive Pulmonary Disease (J44) was introduced with ICD-10-CA and has no equivalents in ICD-9/ICD-9-CM. Cases coded with a primary diagnosis of an acute lower respiratory infection and a secondary diagnosis of J44 in ICD-10-CA or 496 in ICD-9/9CM will be included in the COPD case count. This was undertaken to ensure that COPD cases with acute lower respiratory infections are captured in ICD-9/CM jurisdictions in the same fashion, as they would be in ICD-10-CA jurisdictions, and to compensate for evident erroneous non-application of the combination code in ICD-10-CA jurisdictions.

It was not possible to exclude Dressler's syndrome in jurisdictions coding in ICD-9 as a unique code for this condition does not exist in the ICD-9 classification. As of 2002/03, Quebec is the only jurisdiction in Canada using the ICD-9 classification system, therefore Quebec rates may be slightly higher than elsewhere due to the inclusion of this condition (Dressler's syndrome is coded as 411.0 in ICD-9-CM and I24.1 in ICD-10-CA).

A unique code for Diabetes with hypoglycaemia (ICD-10-CA: E10.63, E11.63, E13.63, E14.63) does not exist in the ICD-9/ ICD-9CM classification systems. This condition was coded using ICD-9 code of 250.7 and ICD-9CM code of 250.8, which also included diabetes with other specific manifestations. However, this has minimal effect on the comparability of rates between ICD-9 and ICD-10 coding jurisdictions.

Table A
Selected characteristics by hospital admission status, household population aged 12 to 74 with ambulatory care sensitive conditions (ACSCs), Canada excluding Quebec, 2000/2001

Characteristics	At least one ACSC hospitalization (n=840)			At least one non-ACSC hospitalization (n=4,149)			No hospitalization (n=11,942)		
	Unadjusted weighted estimate	95% confidence interval from	to	Unadjusted weighted estimate	95% confidence interval from	to	Unadjusted weighted estimate	95% confidence interval from	to
Demographic									
Age									
20 or younger	4.37[E]	2.75	6.89	4.25	3.27	5.50	11.41	10.65	12.23
21 to 40	9.63[E]	6.83	13.42	15.20	13.41	17.18	25.76	24.50	27.07
41 to 60	32.88	27.89	38.28	35.92	33.56	38.34	40.11	38.79	41.45
61 or older	53.12	47.72	58.44	44.64	42.30	47.00	22.71	21.68	23.77
Age									
19 or younger	3.66[E]	2.24	5.91	3.69	2.78	4.90	10.14	9.44	10.90
20 to 64	57.92	52.69	62.98	61.77	59.43	64.07	74.14	73.02	75.22
65 to 74	38.42	33.40	43.69	34.53	32.41	36.73	15.72	14.82	16.66
Sex									
Men	51.85	46.36	57.29	47.17	44.92	49.43	46.96	45.73	48.19
Women	48.15	42.71	53.64	52.83	50.57	55.08	53.04	51.81	54.27
Urban/Rural									
Urban	81.61	77.80	84.90	80.01	78.30	81.61	81.29	80.14	82.38
Rural	18.39	15.10	22.20	19.99	18.39	21.70	18.71	17.62	19.86
Race									
White	89.59	84.28	93.25	92.12	90.22	93.67	85.46	83.93	86.87
Aboriginal	F	F	F	1.37	1.05	1.78	1.26	1.03	1.54
Other visible minority	7.93[E]	4.65	13.20	6.38	4.89	8.27	13.20	11.79	14.75
Socio-economic									
Household income quintile									
Lowest	32.19	27.50	37.28	22.97	20.95	25.13	16.20	15.13	17.33
Lower-middle	21.05	17.18	25.52	18.49	16.72	20.40	17.77	16.69	18.90
Middle	12.96	9.78	16.98	15.74	13.98	17.68	18.41	17.31	19.57
Upper-middle	11.46	8.37	15.49	15.56	13.88	17.41	16.99	15.94	18.08
Highest	9.34	6.85	12.11	13.65	12.10	15.36	19.12	18.01	20.29
Education									
Less than secondary graduation	43.76	39.16	48.46	35.33	33.13	37.60	30.09	28.75	31.46
Secondary graduation	13.75	10.45	17.89	18.50	16.71	20.42	19.35	18.22	20.53
Some postsecondary	7.77[E]	5.43	11.01	7.30	6.25	8.52	7.87	7.15	8.66
Postsecondary graduation	32.38	27.83	37.29	38.26	35.95	40.63	41.92	40.47	43.39
Highest level of household education									
Less than secondary graduation	23.34	19.98	27.07	19.49	17.88	21.21	11.78	10.96	12.64
Secondary graduation	13.47	10.12	17.71	14.74	13.19	16.43	15.01	13.96	16.13
Some postsecondary	10.36[E]	7.31	14.48	7.95	6.73	9.36	7.64	6.93	8.42
Postsecondary graduation	47.94	42.72	53.22	55.77	53.33	58.18	63.36	61.90	64.80
Family/Marital status									
Child, with parent(s)	4.89[E]	3.09	7.64	5.34	4.17	6.83	12.83	11.93	13.78
Married/Common-law	61.40	55.89	66.63	67.41	65.21	69.54	62.94	61.56	64.31
Widowed	11.56	9.13	14.53	9.62	8.46	10.91	4.45	3.95	5.00
Separated/Divorced	14.35	10.63	19.09	8.98	7.82	10.29	7.36	6.69	8.09
Single, never married	7.81[E]	5.48	11.02	8.60	7.33	10.06	12.40	11.42	13.46
Immigrant status									
Non-immigrant	79.56	74.08	84.13	79.65	77.25	81.85	78.65	77.09	80.12
Immigrant (10 years or more in Canada)	18.84	14.54	24.06	18.35	16.25	20.66	17.43	16.08	18.86
Immigrant (less than 10 years in Canada)	F	F	F	1.98[E]	1.22	3.22	3.91	3.23	4.72
Health status									
Self-reported health									
Excellent/Very good	11.46	8.70	14.96	27.70	25.49	30.02	46.43	45.06	47.80
Good	28.90	24.43	33.82	34.16	31.92	36.48	33.98	32.66	35.32
Fair/Poor	59.64	54.69	64.40	38.13	35.76	40.55	19.57	18.42	20.78
Health Utilities Index disability categories									
No disability	6.69[E]	4.64	9.56	10.77	9.19	12.59	18.20	17.12	19.34
Mild disability	30.11	25.86	34.74	38.11	35.70	40.57	46.02	44.50	47.55
Moderate disability	19.27	15.19	24.13	17.51	15.70	19.47	17.74	16.57	18.97
Severe disability	41.89	36.87	47.10	31.92	29.58	34.36	17.16	16.07	18.31
Selected comorbidities[1]									
None	9.83	7.06	13.53	15.19	13.39	17.19	31.95	30.69	33.23
One	27.84	23.29	32.90	37.33	35.00	39.73	41.42	40.05	42.81
Two or more	60.99	55.83	65.91	46.86	44.42	49.31	26.36	25.18	27.58

Table A
Selected characteristics by hospital admission status, household population aged 12 to 74 with ambulatory care sensitive conditions (ACSCs), Canada excluding Quebec, 2000/2001 (concluded)

Characteristics	At least one ACSC hospitalization (n=840)			At least one non-ACSC hospitalization (n=4,149)			No hospitalization (n=11,942)		
	Unadjusted weighted estimate	95% confidence interval		Unadjusted weighted estimate	95% confidence interval		Unadjusted weighted estimate	95% confidence interval	
		from	to		from	to		from	to
Depressed									
Yes	13.86	10.36	18.30	12.01	10.47	13.74	10.32	9.41	11.31
No	84.02	79.50	87.69	85.63	83.82	87.27	88.14	87.11	89.09
Daily stress									
Not at all stressful	14.59	11.33	18.58	12.29	10.83	13.92	10.85	9.98	11.78
Not very stressful	20.08	16.10	24.76	22.64	20.49	24.94	21.21	19.92	22.57
A bit stressful	34.15	29.70	38.90	36.78	34.37	39.26	40.02	38.64	41.41
Quite a bit stressful	21.93	17.88	26.60	21.38	19.44	23.46	22.25	20.94	23.61
Extremely stressful	9.09[E]	5.95	13.67	6.87	5.73	8.23	5.63	4.94	6.42
Impact of health problems									
Sometimes	23.89	19.67	28.70	21.98	20.13	23.95	20.12	18.96	21.34
Often	46.44	41.43	51.53	29.96	27.77	32.25	14.73	13.73	15.78
Never	29.51	25.36	34.02	48.05	45.55	50.56	65.11	63.71	66.49
Usually free of pain									
Yes	51.63	46.27	56.96	63.45	61.10	65.73	77.74	76.40	79.03
No	48.09	42.75	53.48	36.55	34.27	38.90	22.18	20.89	23.53
Health behaviours									
Smoking									
Never	17.44	13.79	21.81	26.90	24.68	29.23	34.72	33.37	36.09
Former	51.55	46.27	56.79	46.92	44.50	49.35	42.22	40.80	43.66
Occasional	2.99[E]	1.84	4.82	3.99[E]	2.87	5.53	3.65	3.16	4.22
Daily	28.03	23.76	32.73	21.97	20.11	23.95	19.20	18.10	20.34
Body mass index									
Underweight	4.43[E]	2.71	7.17	1.60[E]	1.15	2.22	1.55	1.23	1.95
Normal	36.26	31.18	41.67	32.76	30.35	35.27	38.29	36.91	39.69
Overweight	28.64	24.29	33.43	35.43	33.14	37.78	33.77	32.46	35.11
Obese	30.49	25.94	35.46	29.94	27.94	32.03	26.12	24.89	27.39
Physical activity									
Active	16.23	12.83	20.32	16.73	14.93	18.70	22.21	21.08	23.39
Moderately active	13.14	10.25	16.71	20.52	18.50	22.70	23.57	22.34	24.84
Inactive	62.86	57.71	67.74	57.10	54.52	59.65	49.23	47.68	50.78
Vegetable and fruit consumption									
Five or more servings per day	33.71	29.15	38.60	36.20	33.94	38.51	36.81	35.46	38.17
Fewer than five servings per day	65.04	60.14	69.65	62.53	60.24	64.77	62.13	60.73	63.51
Sense of community belonging									
Very strong	20.18	16.53	24.39	20.07	18.35	21.92	17.33	16.28	18.43
Somewhat strong	36.06	30.70	41.80	38.53	36.10	41.01	40.33	38.79	41.89
Somewhat weak	18.67	15.42	22.43	22.07	20.11	24.16	25.09	23.74	26.50
Very weak	17.14	13.51	21.50	13.21	11.50	15.13	11.91	11.03	12.85
Health care experience									
Have regular medical doctor									
Yes	97.65	95.79	98.70	96.41	95.53	97.12	93.45	92.78	94.07
No	2.35[E]	1.30	4.21	3.59	2.88	4.47	6.54	5.93	7.21
Contacts with family doctor in past 12 months									
None	4.24[E]	2.48	7.18	5.96	4.95	7.17	9.04	8.24	9.90
One to three	24.28	19.88	29.31	29.40	27.05	31.87	42.09	40.69	43.51
Four or more	71.23	66.07	75.89	64.43	61.81	66.96	48.78	47.41	50.15
Contacts with specialists in past 12 months									
None	39.57	34.81	44.54	51.11	48.87	53.34	65.08	63.72	66.42
One to three	37.15	32.16	42.43	31.71	29.68	33.80	26.43	25.22	27.68
Four or more	23.28	18.77	28.50	17.03	15.35	18.86	8.43	7.66	9.27
Overnight hospital stay in past 12 months									
Yes	38.29	33.38	43.45	19.22	17.47	21.10	8.71	7.99	9.49
No	61.24	56.06	66.17	80.63	78.73	82.40	91.25	90.47	91.98
At least one unmet health care need in past 12 months									
Yes	17.98	14.38	22.26	16.83	15.21	18.58	15.12	14.14	16.16
No	82.02	77.74	85.62	83.12	81.36	84.74	84.88	83.84	85.86

[1] arthritis, chronic obstructive pulmonary disease, heart disease, cancer, high blood pressure, diabetes
[E] use with caution
[F] too unreliable to be published
Notes: Ambulatory care sensitive conditions (ACSC) are asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure (n=16,931); unadjusted results.
Source: 2000/2001 Canadian Community Health Survey; 2000/2001 to 2004/2005 Hospital Person-Oriented Information.

Table B
Age/sex adjusted odds ratios relating selected demographic, socio-economic, health status, health behaviour and health care experience characteristics to ACSC-related hospitalizations versus no hospitalizations, household population aged 12-74 with ambulatory care sensitive conditions, Canada excluding Quebec, 2000/2001

Characteristics	Age-/Sex-adjusted odds ratio	P-value	95% confidence interval from	to
Demographic				
Urban/Rural				
Urban†	1.00	...	...	...
Rural	0.94	0.612	0.74	1.20
Race				
White†	1.00	...	...	...
Aboriginal	2.70	0.061	0.95	7.67
Other visible minority	0.63	0.171	0.33	1.22
Socio-economic				
Household income quintile				
Lowest	3.96	0.000	2.70	5.82
Lower-middle	2.16	0.000	1.46	3.19
Middle	1.30	0.223	0.85	2.00
Upper-middle	1.46	0.125	0.90	2.38
Highest†	1.00	...	...	...
Education				
Less than secondary graduation	1.77	0.000	1.36	2.31
Secondary graduation	0.94	0.733	0.65	1.35
Some postsecondary	1.50	0.068	0.97	2.31
Postsecondary graduation†	1.00	...	...	...
Highest level of household education				
Less than secondary graduation	1.77	0.000	1.37	2.28
Secondary graduation	1.11	0.580	0.77	1.58
Some postsecondary	1.85	0.004	1.22	2.82
Postsecondary graduation†	1.00	...	...	...
Family/Marital status				
Child, with parent(s)	0.91	0.805	0.43	1.91
Married/Common-law†	1.00	...	...	...
Widowed	1.70	0.002	1.21	2.40
Separated/Divorced	2.25	0.000	1.56	3.23
Single, never married	1.06	0.786	0.70	1.61
Immigrant status				
Non-immigrant†	1.00	...	...	...
Immigrant (10 years or more in Canada)	0.79	0.171	0.56	1.11
Immigrant (less than 10 years in Canada)	0.48	0.405	0.09	2.69
Health status				
Self-reported health				
Excellent/Very good†	1.00	...	...	...
Good	3.04	0.000	2.11	4.37
Fair/Poor	9.87	0.000	7.04	13.82
Health Utilities Index disability categories				
No disability†	1.00	...	...	...
Mild disability	1.12	0.622	0.72	1.75
Moderate disability	2.08	0.005	1.25	3.46
Severe disability	4.33	0.000	2.79	6.72
Select comorbidities‡				
None†	1.00	...	...	...
One	1.63	0.087	0.93	2.85
Two or more	4.47	0.000	2.57	7.76
Depressed				
Yes	2.12	0.000	1.47	3.07
No†	1.00	...	...	...
Daily stress				
Not at all stressful†	1.00	...	...	...
Not very stressful	0.89	0.519	0.61	1.28
A bit stressful	1.06	0.735	0.76	1.46
Quite a bit stressful	1.36	0.116	0.93	1.99
Extremely stressful	2.37	0.004	1.33	4.24
Impact of health problems				
Sometimes	2.77	0.000	2.08	3.70
Often	6.32	0.000	4.86	8.22
Never†	1.00	...	...	...
Usually free of pain				
Yes†	1.00	...	...	...
No	3.12	0.000	2.46	3.94
Health behaviours				
Smoking				
Never†	1.00	...	...	...
Former	1.90	0.000	1.39	2.60
Occasional	2.09	0.018	1.14	3.86
Daily	3.23	0.000	2.32	4.50
Body mass index				
Underweight	3.33	0.001	1.63	6.81
Normal†	1.00	...	...	...
Overweight	0.70	0.018	0.53	0.94
Obese	1.13	0.403	0.84	1.52
Physical activity				
Active†	1.00	...	...	...
Moderate	0.68	0.054	0.47	1.01
Inactive	1.61	0.002	1.19	2.17
Vegetable and fruit consumption				
Five or more servings per day†	1.00	...	...	...
Less than five servings per day	1.27	0.048	1.00	1.61
Sense of community belonging				
Very strong†	1.00	...	...	...
Somewhat strong	0.90	0.516	0.67	1.23
Somewhat weak	0.81	0.176	0.60	1.10
Very weak	1.58	0.010	1.12	2.23
Health care experience				
Have regular medical doctor				
Yes†	1.00	...	...	...
No	0.50	0.038	0.26	0.96
Contacts with family doctor in past 12 months				
None†	1.00	...	...	...
One to three	1.18	0.594	0.64	2.17
Four or more	2.54	0.002	1.41	4.57
Contacts with specialists in past 12 months				
None†	1.00	...	...	...
One to three	2.14	0.000	1.67	2.74
Four or more	4.49	0.000	3.28	6.15
Overnight hospital stay in past 12 months				
Yes	1.57	0.003	1.17	2.10
No†	1.00	...	...	...
At least one unmet health care need in past 12 months				
Yes	6.30	0.000	4.96	8.01
No†	1.00	...	...	...

† reference category
‡ arthritis, chronic obstructive pulmonary disease, heart disease, cancer, high blood pressure, diabetes
... not applicable
Note: Ambulatory care sensitive conditions are asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure.
Source: 2000/2001 Canadian Community Health Survey; 2000/2001 to 2004/2005 Hospital Person-Oriented Information.

Table C
Age/sex adjusted odds ratios relating selected demographic, socio-economic, health status, health behaviour and health care experience characteristics to ACSC-related hospitalizations versus non-ACSC related hospitalizations, household population aged 12-74 with ambulatory care sensitive conditions, Canada excluding Quebec, 2000/2001

Characteristics	Age-/Sex-adjusted odds ratio	P-value	95% confidence interval from	to
Demographic				
Urban/Rural				
Urban†	1.00	...	...	...
Rural	0.88	0.362	0.68	1.15
Race				
White†	1.00	...	...	...
Aboriginal	1.96	0.204	0.69	5.57
Other visible minority	1.34	0.389	0.69	2.62
Socio-economic				
Household income quintile				
Lowest	2.10	0.001	1.39	3.17
Lower-middle	1.60	0.034	1.04	2.46
Middle	1.21	0.431	0.76	1.92
Upper-middle	1.07	0.797	0.64	1.78
Highest†	1.00	...	...	...
Education				
Less than secondary graduation	1.41	0.011	1.08	1.83
Secondary graduation	0.89	0.529	0.61	1.29
Some postsecondary	1.29	0.284	0.81	2.04
Postsecondary graduation†	1.00	...	...	...
Highest level of household education				
Less than secondary graduation	1.30	0.043	1.01	1.68
Secondary graduation	1.06	0.756	0.73	1.56
Some postsecondary	1.55	0.054	0.99	2.42
Postsecondary graduation†	1.00	...	...	...
Family/Marital status				
Child, with parent(s)	1.14	0.757	0.50	2.62
Married/Common-law†	1.00	...	...	...
Widowed	1.23	0.246	0.87	1.75
Separated/Divorced	1.85	0.002	1.27	2.69
Single, never married	1.16	0.483	0.77	1.75
Immigrant status				
Non-immigrant†	1.00	...	...	...
Immigrant (10 years or more in Canada)	0.97	0.883	0.68	1.40
Immigrant (less than 10 years in Canada)	0.86	0.861	0.16	4.72
Health status				
Self-reported health				
Excellent/Very good†	1.00	...	...	...
Good	1.99	0.000	1.37	2.90
Fair/Poor	3.68	0.000	2.59	5.22
Health Utilities Index disability categories				
No disability†	1.00	...	...	...
Mild disability	1.12	0.640	0.70	1.78
Moderate disability	1.63	0.074	0.95	2.80
Severe disability	1.89	0.008	1.18	3.03
Select comorbidities‡				
None†	1.00	...	...	...
One	1.17	0.567	0.69	1.98
Two or more	1.99	0.009	1.19	3.31
Depressed				
Yes	1.41	0.073	0.97	2.05
No†	1.00	...	...	...
Daily stress				
Not at all stressful†	1.00	...	...	...
Not very stressful	0.80	0.245	0.55	1.17
A bit stressful	0.91	0.580	0.64	1.29
Quite a bit stressful	1.03	0.897	0.69	1.53
Extremely stressful	1.37	0.297	0.76	2.49
Impact of health problems				
Sometimes	1.77	0.000	1.31	2.39
Often	2.51	0.000	1.91	3.30
Never†	1.00	...	...	...
Usually free of pain				
Yes†	1.00	...	...	...
No	1.64	0.000	1.28	2.10
Health behaviours				
Smoking				
Never†	1.00	...	...	...
Former	1.63	0.003	1.18	2.24
Occasional	1.21	0.614	0.58	2.51
Daily	2.06	0.000	1.47	2.90
Body mass index				
Underweight	2.52	0.011	1.23	5.14
Normal†	1.00	...	...	...
Overweight	0.69	0.018	0.51	0.94
Obese	0.94	0.683	0.69	1.27
Physical activity				
Active†	1.00	...	...	...
Moderate	0.64	0.033	0.43	0.96
Inactive	1.12	0.468	0.82	1.53
Vegetable and fruit consumption				
Five or more servings per day†	1.00	...	...	...
Less than five servings per day	1.13	0.328	0.88	1.45
Sense of community belonging				
Very strong†	1.00	...	...	...
Somewhat strong	0.97	0.873	0.71	1.34
Somewhat weak	0.91	0.592	0.66	1.27
Very weak	1.35	0.103	0.94	1.95
Health care experience				
Have regular medical doctor				
Yes†	1.00	...	...	...
No	0.71	0.331	0.36	1.42
Contacts with family doctor in past 12 months				
None†	1.00	...	...	...
One to three	1.11	0.744	0.59	2.11
Four or more	1.49	0.201	0.81	2.74
Contacts with specialists in past 12 months				
None†	1.00	...	...	...
One to three	1.51	0.002	1.17	1.94
Four or more	1.80	0.000	1.30	2.50
Overnight hospital stay in past 12 months				
Yes	1.18	0.277	0.87	1.61
No†	1.00	...	...	...
At least one unmet health care need in past 12 months				
Yes	2.65	0.000	2.07	3.39
No†	1.00	...	...	...

† reference category
‡ arthritis, chronic obstructive pulmonary disease, heart disease, cancer, high blood pressure, diabetes
... not applicable
Note: Ambulatory care sensitive conditions are asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure.
Source: 2000/2001 Canadian Community Health Survey; 2000/2001 to 2004/2005 Hospital Person-Oriented Information.

Table D
Patient profiles by predicted probability (quintiles) of experiencing an ACSC-related hospitalization, women, aged 12-74, Canada, excluding Quebec

	Quintile 1			Quintile 2			Quintile 3			Quintile 4			Quintile 5		
		99% confidence interval			99% confidence interval			99% confidence interval			99% confidence interval			99% confidence interval	
Mean Probability (%)	%	from	to	%	from	to	%	from	to	%	from	to	%	from	to
Mean Age (years)	35.26	34.08	36.43	42.75	41.36	44.15	49.22	47.82	50.62	53.62	52.28	54.96	57.60	56.42	58.78
Age															
20 or younger	20.30	17.38	23.57	12.44	10.18	15.13	6.89[F]	4.93	9.56	3.04[F]	1.97	4.69	2.93[F]	1.88	4.55
21 to 40	42.10	38.02	46.30	29.42	25.82	33.30	19.73	16.98	22.82	16.92	13.74	20.67	8.75	6.58	11.54
41 to 60	35.07	30.99	39.37	44.27	40.70	47.90	45.64	41.31	50.04	39.54	35.44	43.80	33.71	29.61	38.06
61 or older	2.54[E]	1.34	4.76	13.87	10.99	17.37	27.73	23.90	31.92	40.49	36.27	44.85	54.61	50.39	58.77
Income Quintiles															
Lowest	6.87	4.98	9.41	12.12	9.58	15.23	18.67	15.67	22.10	19.90	16.99	23.18	43.21	39.07	47.46
Lower Middle	18.43	15.16	22.21	18.92	16.15	22.04	19.55	16.29	23.27	21.67	17.95	25.93	19.59	15.96	23.81
Middle	29.19	25.63	33.02	17.88	14.70	21.57	15.17	12.06	18.91	15.55	12.79	18.78	8.05	6.11	10.53
Upper Middle	21.74	18.76	25.05	18.80	15.77	22.26	14.77	12.15	17.83	13.00	9.82	17.01	5.96	4.48	7.88
Highest	12.85	10.29	15.92	20.49	17.61	23.71	18.20	15.04	21.85	17.26	14.32	20.66	10.12	7.79	13.07
Missing	10.93	7.92	14.91	11.79	9.06	15.20	13.64	10.74	17.19	12.61	9.44	16.66	13.06	10.32	16.40
Select comorbidities[1]															
None	67.55	63.00	71.80	40.27	36.26	44.41	21.56	18.39	25.12	11.83	9.27	14.99	4.30[F]	3.08	5.97
One	32.09	27.87	36.62	53.97	49.83	58.05	52.51	48.08	56.91	30.28	26.35	34.53	17.05	13.89	20.76
Two or more	F	F	F	5.76[F]	4.13	7.97	25.92	22.16	30.08	57.89	53.35	62.30	78.65	74.82	82.03
Smoking															
Never	54.70	50.00	59.31	39.38	35.86	43.01	34.86	30.43	39.57	33.57	29.27	38.15	23.60	20.18	27.39
Former	34.54	30.56	38.75	37.50	33.82	41.34	39.79	35.54	44.19	40.74	36.38	45.24	38.26	33.87	42.86
Occasional	4.37[E]	3.04	6.23	4.14[F]	2.94	5.79	2.60[F]	1.67	4.03	1.74[E]	1.08	2.79	3.53[E]	2.30	5.39
Daily	6.39	4.85	8.37	18.98	15.97	22.41	22.75	19.45	26.43	23.96	20.04	28.36	34.61	30.58	38.87
Body Mass Index (BMI)															
Underweight	F	F	F	F	F	F	F	F	F	3.38[E]	1.95	5.78	7.16	5.15	9.86
Normal	61.62	57.10	65.95	46.42	42.41	50.47	33.51	29.56	37.72	27.53	23.57	31.88	26.80	23.29	30.62
Overweight	20.55	17.55	23.93	30.65	27.04	34.51	33.22	29.11	37.61	31.17	27.20	35.44	31.49	27.78	35.44
Obese	17.69	14.08	21.99	21.77	18.72	25.18	32.15	28.39	36.17	37.92	33.57	42.48	34.56	30.33	39.04
Physical activity index															
Active	29.78	26.11	33.73	21.44	18.32	24.93	18.61	15.31	22.43	14.23	11.28	17.79	9.83	7.78	12.35
Moderate	36.34	32.45	40.41	26.52	23.07	30.28	18.90	15.91	22.30	19.18	15.77	23.13	13.54	10.72	16.95
Inactive	33.89	29.43	38.65	52.05	47.83	56.23	62.49	58.11	66.68	66.60	62.27	70.66	76.63	72.73	80.13
Number of contacts with other doctors (specialists) in the past 12 months															
None	80.57	77.28	83.48	63.98	59.23	68.47	64.67	60.39	68.72	54.12	49.76	58.42	37.52	33.85	41.34
One to three	16.85	14.10	20.01	30.51	26.40	34.95	27.36	23.74	31.30	32.12	27.88	36.66	38.09	34.39	41.92
Four or more	2.58[E]	1.60	4.13	5.52[E]	3.81	7.92	7.97	5.89	10.71	13.76	11.06	17.00	24.40	20.53	28.73
Stayed overnight in the hospital at least once in the past 12 months															
Yes	F	F	F	1.74[F]	0.98	3.09	6.24[F]	4.22	9.14	14.48	11.87	17.55	39.12	34.85	43.56

[1] select chronic conditions include arthritis, chronic obstructive pulmonary disease, heart disease, cancer, high blood pressure and diabetes

Note: Women aged 12 to 74 years in the CCHS who had at least one Ambulator Care Sensitive Condition (ACSC) (asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure).

Source: Linked 2000/01 Canadian Community Health Survey (CCHS) and 2004/05-2005/06 Health Person Oriented Information (HPOI) (excludes Quebec)

Table E
Patient profiles by predicted probability (Quintile 5 subgroups) of experiencing an ACSC-related hospitalization, women, aged 12-74, Canada, excluding Quebec

	Quintile 5 (6%-9%)			Quintile 5 (10% to 49%)			Quintile 5 (50+%)		
		99% confidence interval			99% confidence interval			99% confidence interval	
	%	from	to	%	from	to	%	from	to
Mean Age (years)	55.03	53.30	56.76	58.56	56.99	60.12	64.20	59.70	68.70
Income Quintiles									
Lowest	32.30	27.43	37.58	50.48	44.26	56.69	80.52	63.92	90.60
Lower Middle	18.72	15.08	22.99	19.81	14.34	26.71	F	F	F
Select comorbidities[1]									
None	7.67[E]	5.49	10.62	3.25[E]	1.93	5.44	F	F	F
One	21.34	17.00	26.44	14.91	11.72	18.78	F	F	F
Two or more	70.98	65.52	75.90	81.84	77.71	85.34	98.04	90.58	99.62
Smoking									
Never	30.93	25.73	36.66	18.72	14.38	24.01	F	F	F
Former	33.93	28.82	39.45	43.43	37.17	49.90	40.36[E]	23.30	60.11
Daily	31.43	26.42	36.92	35.17	29.97	40.76	54.86[E]	35.84	72.55
Body Mass Index (BMI)									
Underweight	3.57[E]	2.01	6.26	8.47[E]	5.44	12.96	44.10[E]	25.72	64.24
Normal	28.94	24.19	34.20	23.98	19.37	29.29	F	F	F
Overweight	32.43	27.59	37.68	32.53	27.07	38.51	F	F	F
Obese	35.06	30.26	40.18	35.01	28.81	41.76	F	F	F
Physical activity index									
Active	9.95	7.46	13.14	9.12[E]	6.50	12.64	F	F	F
Moderate	16.25	12.42	20.97	10.43[E]	7.30	14.68	F	F	F
Inactive	73.80	68.74	78.30	80.46	75.33	84.73	92.44	76.90	97.82
Number of contacts with other doctors (specialists) in the past 12 months									
None	45.02	40.06	50.07	29.86	24.87	35.38	29.51[E]	14.30	51.25
One to three	34.29	29.48	39.46	42.84	37.02	48.86	43.70[E]	25.88	63.32
Four or more	20.69	16.18	26.06	27.30	21.09	34.53	26.78[E]	13.47	46.22
Stayed overnight in the hospital at least once in the past 12 months									
Yes	22.07	17.29	27.73	52.76	46.65	58.79	96.25	79.31	99.42

[1] select chronic conditions include arthritis, chronic obstructive pulmonary disease, heart disease, cancer, high blood pressure and diabetes

Note: Women aged 12 to 74 years in the CCHS who had at least one Ambulator Care Sensitive Condition (ACSC) (asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure).

Source: Linked 2000/01 Canadian Community Health Survey (CCHS) and 2004/05-2005/06 Health Person Oriented Information (HPOI) (excludes Quebec)

Table F
Patient profiles by predicted probability (quintiles) of experiencing an ACSC-related hospitalization, men, aged 12-74, Canada, excluding Quebec

	Quintile 1			Quintile 2			Quintile 3			Quintile 4			Quintile 5		
		99% confidence interval			99% confidence interval			99% confidence interval			99% confidence interval			99% confidence interval	
Mean Probability (%)	**%**	**from**	**to**	**%**	**from**	**to**	**%**	**from**	**to**	**%**	**from**	**to**	**%**	**from**	**to**
Mean Age (years)	36.28	35.08	37.48	39.71	38.40	41.02	46.09	44.63	47.55	53.10	51.48	54.72	60.75	59.68	61.82
Age															
20 or younger	18.17	15.05	21.76	15.51	12.51	19.07	6.47[E]	4.47	9.28	6.23[E]	4.11	9.33	F	F	F
21 to 40	42.90	38.33	47.60	32.13	28.20	36.32	25.89	21.56	30.76	12.83	9.64	16.86	5.12[E]	3.29	7.88
41 to 60	38.21	33.89	42.72	46.72	42.61	50.88	48.60	43.76	53.47	40.34	35.58	45.29	28.57	24.74	32.74
61 or older	F	F	F	5.64[E]	3.99	7.93	19.03	15.67	22.92	40.60	35.88	45.50	65.23	60.68	69.51
Income Quintiles															
Lowest	4.74[E]	2.92	7.60	9.69[E]	6.65	13.93	12.47	9.74	15.82	17.89	14.36	22.07	32.11	27.97	36.56
Lower Middle	8.79[E]	6.14	12.43	12.23	9.63	15.42	17.62	14.42	21.35	20.37	16.77	24.53	24.84	20.87	29.30
Middle	14.22	11.16	17.94	23.01	19.40	27.05	16.77	13.73	20.33	21.15	17.17	25.76	14.69	11.83	18.10
Upper Middle	15.62	12.70	19.06	22.04	18.66	25.83	23.49	19.32	28.24	17.03	13.88	20.74	11.72	9.34	14.63
Highest	50.64	45.95	55.32	25.83	22.28	29.73	17.33	14.13	21.07	12.30	9.08	16.45	6.08[E]	3.95	9.24
Missing	5.99[E]	3.69	9.60	7.20[E]	4.90	10.46	12.32[E]	8.74	17.07	11.25	8.17	15.30	10.55[E]	7.41	14.81
Family Status															
Child, with parent(s)	26.71	22.78	31.04	16.23	13.11	19.91	7.14	5.22	9.70	5.46[E]	3.86	7.67	F	F	F
Married/Common-law	63.66	59.10	67.99	63.92	59.34	68.26	68.38	63.68	72.74	70.20	65.22	74.73	72.62	68.31	76.54
Widowed	F	F	F	F	F	F	1.77[E]	1.10	2.84	2.47[E]	1.67	3.63	4.23[E]	2.43	7.27
Separated/Divorced	0.93[E]	0.48	1.81	3.85[E]	2.47	5.94	7.54[E]	5.22	10.79	8.89	6.85	11.46	13.54	10.76	16.90
Single, never married	8.40	6.22	11.24	15.70	12.47	19.58	15.16	11.74	19.36	12.98	9.30	17.84	8.68	6.86	10.92
Health Utilities Index (HUI) disability categories															
No disability	42.73	38.21	47.38	26.09	22.43	30.10	13.56	10.64	17.12	5.18	3.83	6.98	2.45[E]	1.46	4.11
Mild disability	42.86	38.13	47.73	52.49	48.14	56.79	53.12	48.25	57.93	48.93	43.88	54.01	34.06	29.97	38.41
Moderate disability	12.55	9.64	16.18	15.33	12.65	18.47	23.99	19.97	28.53	23.85	19.69	28.58	16.55	13.22	20.52
Severe disability	1.86[E]	1.06	3.24	6.09[E]	3.99	9.19	9.34	6.81	12.67	22.03	17.90	26.81	46.93	42.55	51.36
Smoking															
Never	53.37	48.70	57.99	31.42	27.14	36.03	19.97	16.14	24.43	13.28	9.98	17.46	6.58[E]	4.39	9.75
Former	30.35	26.42	34.59	47.09	42.71	51.51	52.64	47.77	57.46	60.90	55.94	65.64	67.42	62.67	71.85
Occasional	6.27[E]	4.46	8.74	4.86[E]	3.14	7.44	F	F	F	2.66[E]	1.67	4.24	F	F	F
Daily	10.01	7.50	13.25	16.64	13.59	20.20	24.01	20.08	28.42	23.16	19.28	27.55	24.20	20.13	28.80
Number of contacts with other doctors (specialists) in the past 12 months															
None	85.98	82.24	89.03	77.29	73.32	80.83	71.90	67.05	76.29	57.75	52.69	62.65	27.27	23.42	31.48
One to three	13.69	10.64	17.45	20.78	17.29	24.76	22.89	18.56	27.87	32.92	28.62	37.52	44.69	40.02	49.45
Four or more	F	F	F	1.93[E]	1.04	3.53	5.21[E]	3.44	7.81	9.33[E]	6.32	13.57	28.05	23.84	32.68
Stayed overnight in the hospital at least once in the past 12 months															
Yes	F	F	F	F	F	F	3.83[E]	2.59	5.65	10.55	7.59	14.48	38.54	34.09	43.18

Note: Men aged 12 to 74 years in the CCHS who had at least one Ambulator Care Sensitive Condition (ACSC) (asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure).
Source: Linked 2000/01 Canadian Community Health Survey (CCHS) and 2004/05-2005/06 Health Person Oriented Information (HPOI) (excludes Quebec)

Table G
Patient profiles by predicted probability (Quintile 5 subgroups) of experiencing an ACSC-related hospitalization, men, aged 12-74, Canada, excluding Quebec

	Quintile 5 (0.09-0.25)			Quintile 5 (0.26-0.50)			Quintile 5 (>0.50)		
		99% confidence interval			99% confidence interval			99% confidence interval	
	%	from	to	%	from	to	%	from	to
Mean Age (years)	59.49	58.15	60.83	63.43	61.91	64.95	66.74	64.94	68.54
Income Quintiles									
Lowest	31.09	26.17	36.49	34.47	26.10	43.94	35.31[E]	20.19	54.06
Lower Middle	24.15	19.55	29.43	28.34	20.26	38.10	22.88[E]	12.42	38.31
Family Status									
Married/Common-law	74.22	69.19	78.69	66.77	57.33	75.03	71.99	53.99	84.92
Widowed/Separated/Divorced	15.20	11.40	20.00	24.90[E]	17.45	34.22	25.52[E]	13.30	43.36
Health Utilities Index (HUI) disability categories									
Mild disability	37.83	32.92	43.01	28.89	20.43	39.13	F	F	F
Moderate disability	16.85	12.80	21.85	15.41[E]	9.18	24.71	F	F	F
Severe disability	41.97	36.87	47.24	55.71	45.62	65.35	75.32	56.72	87.67
Smoking									
Never	6.94[E]	4.49	10.59	F	F	F	F	F	F
Former	65.62	59.93	70.90	70.14	59.91	78.69	80.11	62.39	90.72
Daily	25.35	20.36	31.08	21.51[E]	14.97	29.89	F	F	F
Number of contacts with other doctors (specialists) in the past 12 months									
None	33.18	28.10	38.69	12.79[E]	8.49	18.82	F	F	F
One to three	45.55	39.95	51.26	48.53	39.17	58.00	21.58E	12.07	35.55
Four or more	21.27	16.97	26.32	38.68	29.58	48.64	71.20	54.96	83.35
Stayed overnight in the hospital at least once in the past 12 months									
Yes	28.05	23.33	33.31	62.09	51.78	71.41	83.52	53.20	95.76

Note: Men aged 12 to 74 years in the CCHS who had at least one Ambulator Care Sensitive Condition (ACSC) (asthma, emphysema/COPD, diabetes, epilepsy, heart disease and high blood pressure).
Source: Linked 2000/01 Canadian Community Health Survey (CCHS) and 2004/05-2005/06 Health Person Oriented Information (HPOI) (excludes Québec)